

## Pre-AP Geometry 2-6 Study Guide: Geometric Proof (pp 110-112)

Page 1 of 11

**Attendance Problems:** Determine whether each statement is true or false. If false, give a counterexample.

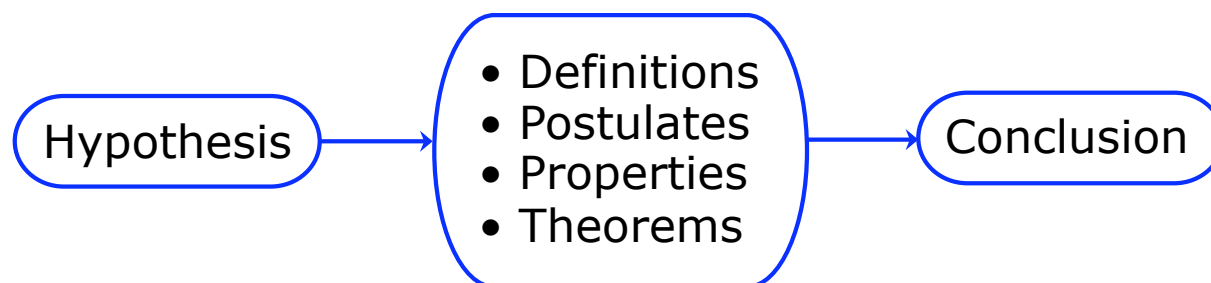
1. \_\_\_\_\_ It two angles are complementary, then they are not congruent.
  
  
  
  
  
  
  
  
  
  
2. \_\_\_\_\_ If two angles are congruent to the same angle, then they are congruent to each other.
  
  
  
  
  
  
  
  
  
  
3. \_\_\_\_\_ Supplementary angles are congruent.

- I can write two-column proofs.
- I can prove geometric theorems by using deductive reasoning.

Vocabulary	
theorem	two-column proof

**Common Core:** CC.9-12.G.CO.9 Prove geometric theorems about lines and angles.

**When writing a proof, it is important to justify each logical step with a reason. You can use symbols and abbreviations, but they must be clear enough so that anyone who reads your proof will understand them.**



**Video Example 1.** Write a justification for each step, given that  $\angle E$  &  $\angle G$  are supplementary and  $\angle E \cong \angle H$ .

Statement	Reason
$\angle E$ & $\angle G$ are supplementary.	
$m\angle E + m\angle G = 180^\circ$	
$\angle E \cong \angle H$ .	
$m\angle E = m\angle H$	
$m\angle H + m\angle G = 180^\circ$	
$\angle H$ & $\angle G$ are supplementary	

**1**

## Writing Justifications

Write a justification for each step, given that  $\angle A$  and  $\angle B$  are complementary and  $\angle A \cong \angle C$ .

- $\angle A$  and  $\angle B$  are complementary.
- $m\angle A + m\angle B = 90^\circ$
- $\angle A \cong \angle C$
- $m\angle A = m\angle C$
- $m\angle C + m\angle B = 90^\circ$
- $\angle C$  and  $\angle B$  are complementary.

Given information

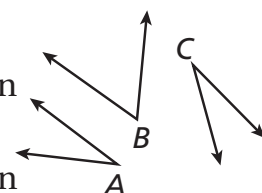
Def. of comp.  $\angle$

Given information

Def. of  $\cong \angle$

Subst. Prop. of = *Steps 2, 4*

Def. of comp.  $\angle$



**Q:** What do you have to know to get top grades in geometry?

**A:** All the angles!

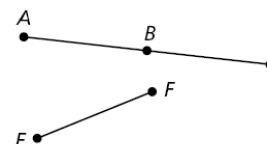
# Pre-AP Geometry 2-6 Study Guide: Geometric Proof (pp 110-112)

Page 3 of 11

**Example 1.** Write a justification for each step, given that  $\angle A$  and  $\angle B$  are supplementary and  $m\angle A = 45^\circ$ .

Statement	Reason
$\angle A$ and $\angle B$ are supplementary	
$m\angle A = 45^\circ$	
$m\angle A + m\angle B = 180^\circ$	
$45^\circ + m\angle B = 180^\circ$	
$m\angle B = 135^\circ$	

**4. Guided Practice:** Write a justification for each step, given that  $B$  is the midpoint of  $\overline{AC}$  and  $\overline{AB} \cong \overline{EF}$ .



Statement	Reason
1. $B$ is the midpoint of $\overline{AC}$ .	
2. $\overline{AB} \cong \overline{BC}$	
3. $\overline{AB} \cong \overline{EF}$	
4. $\overline{BC} \cong \overline{EF}$	

"If you can write a nation's stories, you needn't worry about who makes its laws. Today, television tells most of the stories to most of the people most of the time." -- *George Gerbner*

5. What is a theorem?

## Theorem

THEOREM	HYPOTHESIS	CONCLUSION
<b>2-6-1 Linear Pair Theorem</b> If two angles form a linear pair, then they are supplementary.	$\angle A$ and $\angle B$ form a linear pair.	$\angle A$ and $\angle B$ are supplementary.

## Theorem

THEOREM	HYPOTHESIS	CONCLUSION
<b>2-6-2 Congruent Supplements Theorem</b> If two angles are supplementary to the same angle (or to two congruent angles), then the two angles are congruent.	$\angle 1$ and $\angle 2$ are supplementary. $\angle 2$ and $\angle 3$ are supplementary.	$\angle 1 \cong \angle 3$

A geometric proof begins with *Given* and *Prove* statements, which restate the hypothesis and conclusion of the conjecture. In a **two-column proof**, you list the steps of the proof in the left column. You write the matching reason for each step in the right column.

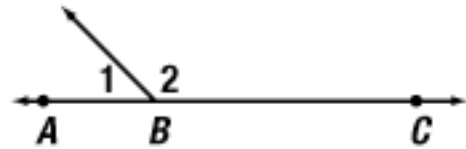
# Pre-AP Geometry 2-6 Study Guide: Geometric Proof (pp 110-112)

Page 5 of 11

**Video Example 2.** Fill in the blanks to complete a two-column proof of the Linear pair theorem.

**Given:**  $\angle 1$  &  $\angle 2$  form a linear pair.

**Prove:**  $\angle 1$  &  $\angle 2$  are supplementary



Statement	Reason
$\angle 1$ & $\angle 2$ form a linear pair.	
$\overrightarrow{BA}$ & $\overrightarrow{BC}$ form a line.	
$m\angle ABC = \underline{\hspace{2cm}}$	Definition of a straight angle.
$m\angle 1 + m\angle 2 = m\angle ABC$	Angle addition postulate.
$m\angle 1 + m\angle 2 = 180^\circ$	
$\angle 1$ & $\angle 2$ are supplementary	

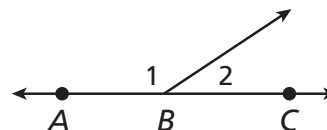
## 2 Completing a Two-Column Proof

Fill in the blanks to complete a two-column proof of the Linear Pair Theorem.

Given:  $\angle 1$  and  $\angle 2$  form a linear pair.

Prove:  $\angle 1$  and  $\angle 2$  are supplementary.

Proof:



Statements	Reasons
1. $\angle 1$ and $\angle 2$ form a linear pair.	1. Given
2. $\overrightarrow{BA}$ and $\overrightarrow{BC}$ form a line.	2. Def. of lin. pair
3. $m\angle ABC = 180^\circ$	3. Def. of straight $\angle$
4. a. <u>      ?</u>	4. $\angle$ Add. Post.
5. b. <u>      ?</u>	5. Subst. <i>Steps 3, 4</i>
6. $\angle 1$ and $\angle 2$ are supplementary.	6. c. <u>      ?</u>

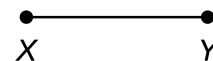
Use the existing statements and reasons in the proof to fill in the blanks.

- a.  $m\angle 1 + m\angle 2 = m\angle ABC$      *The  $\angle$  Add. Post. is given as the reason.*  
b.  $m\angle 1 + m\angle 2 = 180^\circ$      *Substitute  $180^\circ$  for  $m\angle ABC$ .*  
c. Def. of supp.  $\angle$      *The measures of supp.  $\angle$  add to  $180^\circ$  by def.*

**Example 2.** Fill in the blanks to complete the two-column proof.

Given:  $\overline{XY}$

Prove:  $\overline{XY} \cong \overline{XY}$



Statement	Reason
	Given
$XY = XY$	
	Definition of congruent segments

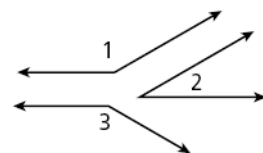
# Pre-AP Geometry 2-6 Study Guide: Geometric Proof (pp 110-112)

Page 7 of 11

**6. Guided Practice: Fill in the blanks to complete a two-column proof of one case of the Congruent Supplements Theorem.**

**Given:**  $\angle 1$  &  $\angle 2$  are supplementary and  $\angle 2$  &  $\angle 3$  are supplementary.

**Prove:**  $\angle 1 \cong \angle 3$



Statement	Reason
	Given
$m\angle 1 + m\angle 2 = 180^\circ$ $m\angle 2 + m\angle 3 = 180^\circ$	Definition of supplementary angles.
	Substitution.
$m\angle 2 = m\angle 2$	Reflexive property of equality.
$m\angle 1 = m\angle 3$	
	Definition of congruent angles.

**Before you start writing a proof, you should plan out your logic. Sometimes you will be given a plan for a more challenging proof. This plan will detail the major steps of the proof for you.**

## Theorems

THEOREM	HYPOTHESIS	CONCLUSION
<b>2-6-3 Right Angle Congruence Theorem</b> All right angles are congruent.	$\angle A$ and $\angle B$ are right angles.	$\angle A \cong \angle B$
<b>2-6-4 Congruent Complements Theorem</b> If two angles are complementary to the same angle (or to two congruent angles), then the two angles are congruent.	$\angle 1$ and $\angle 2$ are complementary. $\angle 2$ and $\angle 3$ are complementary.	$\angle 1 \cong \angle 3$

## Helpful Hint

If a diagram for a proof is not provided, draw your own and mark the given information on it. But do not mark the information in the Prove statement on it.



## Pre-AP Geometry 2-6 Study Guide: Geometric Proof (pp 110-112)

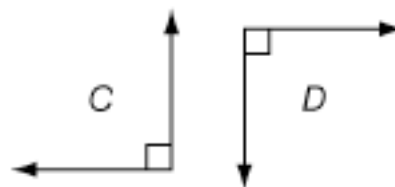
Page 9 of 11

**Video Example 3.** Use the given plan to write a two-column proof.

**Given:**  $\angle C$  &  $\angle D$  are right angles.

**Prove:**  $\angle C \cong \angle D$

**Plan:** Use the definition of a right angle to write the measure of each angle. Then use the Transitive Property and the definition of congruent angles.



### 3 Writing a Two-Column Proof from a Plan

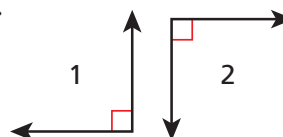
Use the given plan to write a two-column proof of the Right Angle Congruence Theorem.

**Given:**  $\angle 1$  and  $\angle 2$  are right angles.

**Prove:**  $\angle 1 \cong \angle 2$

**Plan:** Use the definition of a right angle to write the measure of each angle. Then use the Transitive Property and the definition of congruent angles.

**Proof:**



Statements	Reasons
1. $\angle 1$ and $\angle 2$ are right angles.	1. Given
2. $m\angle 1 = 90^\circ$ , $m\angle 2 = 90^\circ$	2. Def. of rt. $\angle$
3. $m\angle 1 = m\angle 2$	3. Trans. Prop. of =
4. $\angle 1 \cong \angle 2$	4. Def. of $\cong \angle$ s

## Pre-AP Geometry 2-6 Study Guide: Geometric Proof (pp 110-112)

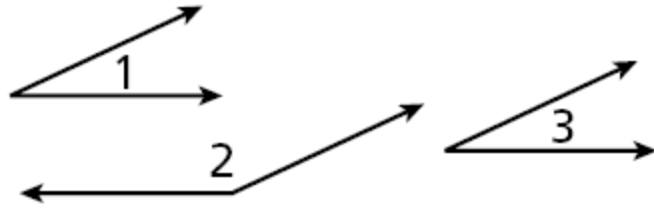
Page 10 of 11

**Example 3.** Use the given plan to write a two-column proof.

**Given:**  $\angle 1$  &  $\angle 2$  are supplementary and  $\angle 1 \cong \angle 3$

**Prove:**  $\angle 3$  &  $\angle 2$  are supplementary.

**Plan:** Use the definitions of supplementary and congruent angles and substitution to show that  $m\angle 3 + m\angle 2 = 180^\circ$ . By the definition of supplementary angles,  $\angle 3$  and  $\angle 2$  are supplementary.



## Pre-AP Geometry 2-6 Study Guide: Geometric Proof (pp 110-112)

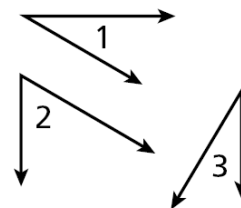
Page 11 of 11

**7. Guided Practice:** Use the given plan to write a two-column proof if one case of Congruent Complements Theorem.

**Given:**  $\angle 1$  &  $\angle 2$  are complementary and  $\angle 2$  &  $\angle 3$  are complementary.

**Prove:**  $\angle 1 \cong \angle 3$

**Plan:** The measures of complementary angles add to  $90^\circ$  by definition. Use substitution to show that the sums of both pairs are equal. Use the Subtraction Property and the definition of congruent angles to conclude that  $\angle 1 \cong \angle 3$ .



**2-6 Geometric Proof** (p 114) 6-10, 15-19, 22-24, 28, 30.

